

From the mouth of the Pit to tidewater the Sacramento River averaged from 0.5 of a foot to nearly 1 foot below the average stages of the preceding month. The average stage at Sacramento City, 4.6 feet, is 0.1 of a foot below the lowest previous average of which there is a record.

The rivers of the Feather-Yuba Watershed maintained stages slightly higher than those of the preceding month, and the American River averaged 0.2 of a foot below. For mining purposes water was not plentiful, but there were no complaints from power companies.

Notwithstanding the extreme low water in the Sacramento River there were no serious or prolonged interruptions in navigation, the tides being appreciably felt well above the mouth of the American.

Lower San Joaquin Watershed.—The occurrence of rainfall in this watershed was coincident with that of the Sacramento, but there was no rise in any stream greater than 0.5 of a foot, and the average stages generally showed little departure from those of the preceding month.

NOTES ON STREAMS OF THE UPPER SAN JOAQUIN WATERSHED.

By W. E. BONNETT, Local Forecaster.

No noteworthy changes occurred in the stages of streams of this district during October, the stage at every point, already low at the beginning of the month, showing a slight decline on November 1. The sources of water supply have held out fairly well, but no considerable amount of precipitation to increase the flow has occurred in these watersheds during the early autumn months.

Late cuttings of alfalfa in sections dependent on ditch water are very light, but no serious or permanent injury appears to have resulted from the short water supply. As there has been practically no rain, foothill ranges have not started.

FROST STUDIES.

By A. G. MCADIE.

NOTE ON THAWING AND DEFROSTING.

In answering a request for information from a large fruit company concerning the efficiency of burning baled straw to protect crops from frost, it became necessary to discuss the problem of the prevention of rapid heating of chilled vegetable tissue. During the frost of December 26, 1911, in southern California, when several million dollars worth of citrus fruit was damaged, it was noted that at many points in the citrus belt there was a rise of 15° F. in temperature between 7 a. m. and 9 a. m. At some places there was a rise of 20° F. At one station there was a rise of 24° in 2 hours and it was said that no damage resulted, which seems doubtful. Between 9 and 10 a. m., on the frosty morning at one place the temperature rose 17° in 1 hour and at another orchard there was a rise of 16°. Such rapid rises after the fruit had been for a period of 6 hours at a temperature of 20° to 24° might account for destructive changes in the cell tissue. It would appear that the most effective frost-protection method would be one devised with special reference to the prevention of such rapid heating of chilled vegetable tissue. Following this line of investigation an inquiry was submitted to the Bureau of Plant Industry, and Dr. William A. Taylor,

assistant chief of the bureau, and Prof. A. V. Stubenrauch, answered the question as follows:

Answering the inquiry as to whether frost-protective methods could not be devised with special reference to the prevention of such rapid heating of chilled vegetable tissue as occurred in connection with the disastrous freeze of December 26 last, in southern California, studies made by Stubenrauch and his assistants on the effect of freezing of oranges, which work was done in a cold-storage warehouse where the fruits were allowed to remain in a cold temperature for a much longer time than is the case on frosty nights, show that the length of time the fruit remains in a frozen condition has a very material effect upon its condition after thawing out. There is apparently an optimum temperature for thawing the frozen fruit with the least resultant injury. If the thawing is done too slowly, the fruit is injured more than where a somewhat higher defrosting temperature is used and the thawing accomplished more quickly. On the other hand, it was found that quick defrosting was more injurious than slow defrosting, so that it appears probable that through experimentation the defrosting temperature which would be most effective could be determined.

Of course storage-house conditions, both as regards frosting and defrosting, are very different from those to which fruit on the trees is subjected during a frost.

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Undoubtedly the most important thing in connection with frost fighting in the field is to prevent the foliage and fruit from being frosted. Where this is not possible it seems probable that anything which would considerably retard the defrosting would be helpful by permitting the gradual restoration of the tissues and juices to their normal state.

APPLES, CODLING MOTH, AND CLIMATE.

By Prof. C. W. WOODWORTH, of the University of California.

The following paper is a portion of an address entitled "The Battle of the Arsenicals," read at the Watsonville Apple Show, October, 1910, and is reproduced through the courtesy of the editor of the Pacific Rural Press.

It is undoubtedly true that nowhere in the world is there an area planted to any crop of the extent of the apple orchards in this valley, where spraying is so universally and efficiently done, and there is no similar area where such difficulties have to be surmounted in order to place spraying on a practical basis. The story of the horticultural achievements of the Pajaro Valley will always include the contribution here made to the means of controlling insect pests.

Just a quarter of a century ago I had the privilege of taking part, under the direction of Prof. Forbes in Illinois, in the first thorough scientific experiments made to test the efficiency of arsenicals in the control of the codling moth. This method has gradually extended until now spraying with these substances has become an essential part of the practice of apple growing in every region which figures in the commercial production of this fruit. * * * The conquering of the codling moth has been the work of the last eight years. Previous to 1903 spraying for the codling moth was not extensive enough to produce any appreciable effect on the apple market in this valley. Even to-day the good which can come from spraying is only a little over half realized. While we have a right to felicitate ourselves upon the progress thus far made, that this valley to-day leads the world in this phase of the fight for perfect fruit, let us realize that this preeminence can only be maintained by improving the spraying practice over the greater portion of the present acreage, bringing it in line with the best practice in the valley. Many orchards are experiencing a loss from codling moth notwithstanding their spraying work, of between 10 and 20 per cent, while adjacent orchards under identical climatic conditions suffer a loss of less than 1 per cent. * * *

Prof. Woodworth here gives the history of the work carried on in the attempt to prove that the arsenicals were not inefficient, as those who had previously experimented in the valley had concluded. It soon developed that the most serious problem was how to so apply the arsenicals that the foliage should not be damaged. The work was full of failures in its early stages and it became necessary to test out all the brands of arsenicals on the market, other than Paris green, and especially the lead arsenates. The most significant discovery of the year 1906 was that when a lead arsenate was so compounded that all the arsenic acid present was combined with lead no injury was produced on the most delicate foliage.